

REMARKS

Claims 1-4 and 8-23 are in this application. Applicant respectfully requests re-examination.

Claims 1-3 and 9-10 were rejected under 35 USC §103 as unpatentable over U.S. Patent Application Pub. No. 2002/0182547 ("Raguin") in view of U.S. Patent Application Pub. No. 2002/0088393 ("Kitano"). Applicant respectfully traverses.

*Raguin* was cited for teachings relative to fabricating structures on a substrate by rotating the substrate and by spraying a low-contrast photoresist onto the substrate at an angle to the substrate surface while moving the spray pattern diametrically across the substrate. *Kitano* is cited for teachings relative to an automated process for film coating, including teachings for moving a spray pattern at different speeds across a rotating wafer.

Claim 1 is amended to include the following limitation:

*preparing a mixed solvent based resist from a photoresist solution and a solvent having a higher volatility rate than the photoresist solution, the mixed solvent based resist having a viscosity between about one and about three centipoises.*

This amendment is fully supported in the specification, e.g., at paragraph 0027. Neither *Raguin* nor *Kitano* nor any combination of the two teach preparing a mixed solvent based resist from a photoresist solution and a solvent having a higher volatility rate than the photoresist solution. Claim 1 should be allowed on this basis alone.

Moreover, neither *Raguin* nor *Kitano* nor any combination of the two teach using a mixed solvent based resist to achieve a viscosity in the range claimed. Claim 1 should be allowed on this basis alone.

On page 3 of the Final Office Action, *Kitano* is inaccurately credited with teaching resist liquid viscosity in the same range claimed by the Applicant. For support, the Final Office Action cites to *Kitano* at paragraphs 0138, 0139 and 0160, and FIGS. 23 and 29. These citations, however, do not support the rejection.

- Paragraph 0138 says nothing about resist solution viscosity.
- Paragraph 0139 states merely that viscosity, discharge pressure, and flow rate depend on the solid content quantity in the coating liquid. No values of viscosity are given.
- Paragraph 0160 states that solid content quantity in % corresponds to viscosity in units of Pascal-seconds (Pa·s), and that

the solid content quantity corresponding to  $\alpha$  (Pa·s) is in the range of 0.1 to 0.5 (%), while the solid content quantity shown in FIG. 27 is in the range of 1.0 to 2.0 (%).

But *Kitano* discloses no numerical ranges for viscosity. *Kitano* gives no value for the parameter  $\alpha$ . *Kitano* provides no equation for computing viscosity given a solid content quantity.

- FIGS. 23 and 29 of *Kitano* provide no quantitative data at all. FIGS. 27 and 30 likewise fail to disclose numerical ranges for viscosity.

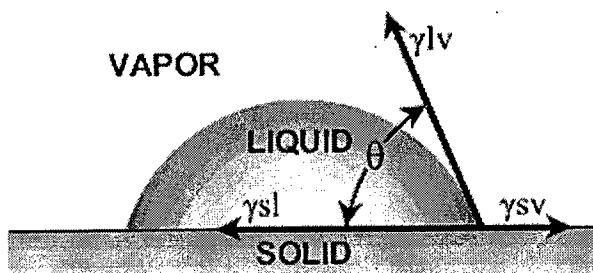
The *Kitano* disclosure provides a top-level conceptual design for a computerized apparatus for controlling discharge pressure, flow rate, and viscosity of a resist liquid during a wafer-coating process. *See Kitano* at FIG. 28 and paragraphs 0156 to 0162. *Kitano* fails to teach any numerical ranges for any of the parameters under control, and fails to provide a single numerical example relevant to the claims under examination.

While *Kitano* may disclose a functional dependence of discharge pressure and flow rate on solution viscosity, this is a basic concept that is well-known in the field of fluid mechanics. *Kitano* falls short of teaching or suggesting a “mixed solvent based resist having a viscosity between about one and about three centipoises” as recited in claim 1. Applicant requests that the rejection of claim 1 be withdrawn.

Claims 2-4 and 8-10 all depend from claim 1. Based on the foregoing arguments in support of patentability of claim 1, Applicant requests that the rejection of these claims also be withdrawn.

Claim 2, specifically, should be allowed because no *prima facie* rejection of this claim was set forth in the Final Office Action. Claim 2 is amended for clarity to recite “priming the surface of the substrate with a primer to achieve a water contact angle between about forty and about fifty degrees.” Applicant notes that “water contact angle” is a physical property of a surface, and is not related to the spray angle.

Consider a static drop of water resting on the primed surface, as in FIG. 4. The water contact angle is the angle formed between the solid/liquid interface and the liquid/vapor interface and which has a vertex where the three interfaces meet. It is derived from Young’s Equation:  $\gamma^{SV} = \gamma^{SL} + \gamma^{LV} \cos\theta$ , where  $\theta$  is the contact angle,  $\gamma^{SL}$  is the solid/liquid interfacial free energy,  $\gamma^{SV}$  is the solid surface free energy, and  $\gamma^{LV}$  is the liquid surface free energy. *See also* [www.ramehart.com/goniometers/contactangle.htm](http://www.ramehart.com/goniometers/contactangle.htm).



Since none of the cited references teach priming a substrate with a coat of primer to achieve a water contact angle in the range claimed, the rejection of claim 2 should be withdrawn.

Claim 3, specifically, was rejected based on *Raguin* teaching spray coating in an environment saturated with vapor. Claim 3 is amended to recite a step comprising “spraying in an environment having relative humidity lower than fifty percent.” This amendment is fully supported in the original specification at paragraph 0031. Applicant submits that this feature is not taught in any of the cited references, and on this basis requests that the rejection of claim 3 be withdrawn.

Claims 4 and 8 were rejected under 35 USC §103 as unpatentable over *Raguin* in view of *Kitano* and in further view of U.S. Patent Appl. No. 2004/0185368 (“*Dammel*”). *Dammel* is cited for teaching the use of cyclohexanone-based and propylene glycol monomethyl ether acetate based resist compositions, and the use of methyl-ethyl-ketone solvent in photoresist compositions. Applicant respectfully traverses.

The rejections of claims 4 and 8 should be withdrawn because none of the cited references teach using a mixed solvent based resist solution wherein the photoresist solution-to-solvent ratio for either negative or positive-tone resist lies in any of the ranges claimed. The Final Office Action cited to *Dammel* at paragraphs 0028, 0035 and 0036 as evidence that *Dammel* teaches this ratio in the ranges claimed. These paragraphs, however, fail to support the rejections.

- Paragraph 0028 teaches adding surfactants (not solvents) to photoresist. Surfactants are wetting agents that lower the surface tension of a liquid, and

are added to a solution in minuscule quantities, e.g. 2000 to 14,000 ppm. *Dammel*, 0028.

- Paragraph 0035 says nothing about ratios in a mixed solvent. Paragraph 0035 teaches that “the resist solution can be adjusted with respect to the percentage of solids content”. However, claims 4 and 8 recite limitations on photoresist solution-to-solvent ratio in a mixed solvent solution, not limitations on percentage solid content in a homogeneous solvent. In any case, no numerical ratios are taught or suggested by *Dammel* that fall within the ranges of ratios claimed.
- Paragraph 0036 describes various compositions in substrate material, and teaches nothing about the composition of photoresist solution.

Based on the above, Applicant requests withdrawal of the rejections of claims 4 and 8.

Claims 11 and 13-18 were rejected under 35 USC §103 as unpatentable over *Raguin* in view *Research Disclosure* (Kenneth Mason Publications, vol. 324, April 1991) (hereinafter “*RD91*”). *RD91* is cited for teaching washing a substrate by immersion in solution followed by rinsing in water prior to priming. Applicant respectfully traverses.

Claim 11 is amended to recite “coating the substrate with a primer by immersing it into a priming solution.” This amendment is fully supported in the specification at paragraph 0034 (“the substrate is primed by immersion into a priming liquid 508”).

Neither *Raguin* nor *RD91* nor any combination thereof teaches priming a substrate by coating the substrate with a primer. The Final Office Action states that *Raguin* at paragraph 0033 teaches priming a substrate “with suitable solutions, solvents,

acid solutions ... etc." *Raguin*, however, teaches "cleaning the surface to promote adhesion of the photosensitive material." *Raguin*, paragraph 0033. Similarly, *RD91* teaches "a process to clean the surface of a stainless steel and copper laminate prior to the application of a dry film photoresist ...." There is no teaching or suggestion in either reference to coat the substrate with a separate layer of primer. Applicant requests that the rejection of claim 11 be withdrawn.

Moreover, claim 11 is amended to recite "spraying a mixed solvent based resist through a spray nozzle onto a surface of the substrate ...." Since neither *Raguin* nor *RD91* teach a mixed solvent based resist, Applicant submits this as an independent basis for allowing claim 11 over the cited references. Based on the foregoing arguments for patentability of claim 11, Applicant further requests withdrawal of the rejections of claims 12-18 based on dependency from claim 11.

Claim 15 is amended to recite "wherein the second drying step produces a primed substrate surface having a water contact angle of between about forty and about fifty degrees." Neither *Raguin* nor *RD91* teach drying a primer on a substrate to create a water contact angle in this range. The Final Office Action states on page 5 that *Raguin* at 0033 teaches "contact angle less than 90<sup>0</sup>." However, there is simply no teaching anywhere in *Raguin* for water contact angles in the range claimed by Applicant, or in any other range. *See* discussion above re Young's Equation. Applicant requests withdrawal of the rejection of claim 15.

Claim 16 is amended to recite a "spraying step [for] spraying the mixed solvent based resist in an environment having relative humidity lower than fifty percent."

Applicant reasserts here the arguments made above in support of claim 3. Applicant requests withdrawal of the rejection of claim 16.

Claims 17 and 18 are amended to recite ranges for photoresist solvent-to-solution ratios. Applicant reasserts here the arguments made above in support of claims 4 and 8. Applicant requests withdrawal of the rejections of claims 17 and 18.

Claim 12 was rejected under 35 USC §103 as unpatentable over *Raguin* in view of *RD91* and in further view of U.S. Patent No. 4,791,465 (“*Sakai*”). *Sakai* is cited for teachings relative to immersing a substrate in a peroxide-sulfuric solution. Applicant respectfully traverses.

Claims 12 depends from claim 11. Applicant reasserts here all of the foregoing arguments in support of patentability of claim 11. Applicant requests that the rejection of claim 12 be withdrawn.

New claims 19-23 are fully supported in the specification. Claims 19-21 and 23 recite subject matter disclosed in the specification at paragraph 0027. Claim 22 recites process steps disclosed in the specification, *e.g.*, at paragraphs 0030 (applying a primer), 0018 (rotating the substrate), 0021 and 0027 (spraying a mixed solvent based resist), and 0023 (accelerating the spray nozzle diametrically across the substrate).

In view of the above amendment and remarks, applicant respectfully submits that all the claims are now in condition for allowance and respectfully requests that this application be passed to issue.

Very truly yours,

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